HARKEN®

HYDRO POWER UNIT 3

Installation and Operation Manual
Intended for specialized personnel or expert users

Please read these instructions carefully before installing, servicing, or operating the equipment.
This manual may be modified without notice. See: www.harken.com/manuals for updated versions.
PLEASE SAVE THESE INSTRUCTIONS

The Hydro Power Unit pictured above is for display purposes only. Actual system purchased may vary.

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Introduction

HARKEN Hydraulic Power Units (HPU) are the complete power solution. Offered in three sizes (Hydro 1, 2 and 3), the HPU can power functions including winches, furlers, sail trim cylinders, windlasses and keel cylinders. HPUs can include waterproof, prewired electronic control boxes (ECB) or act as stand–alone, central or supplemental power units.

HARKEN HPU features a 4kW 24VDC motor which is sized alongside the pump to power a single function. With additional pumps and motors, multiple functions can run simultaneously, or the built-in double-flow feature can supply more oil to power-intensive functions. Motors are fan-cooled, series-wound and energy-efficient at all speeds.

Factory-installed manifolds and pumps are internally plumbed, saving space, installation time and additional hardware. Valve manifolds are equipped with horizontal ports to provide ease with hose routing. Elevated reservoir fill cap keeps oil from spilling, filters air exchange and removes moisture from the tank to ensure a healthy hydraulic power unit. Drop-in return line filters with status gauge make maintenance fast and easy.

The prewired ECB features sealed passage for switch and valve wires. The ECB is prewired internally and contacts are labeled. The user is required to make electrical connections for supply power, switches and valves.

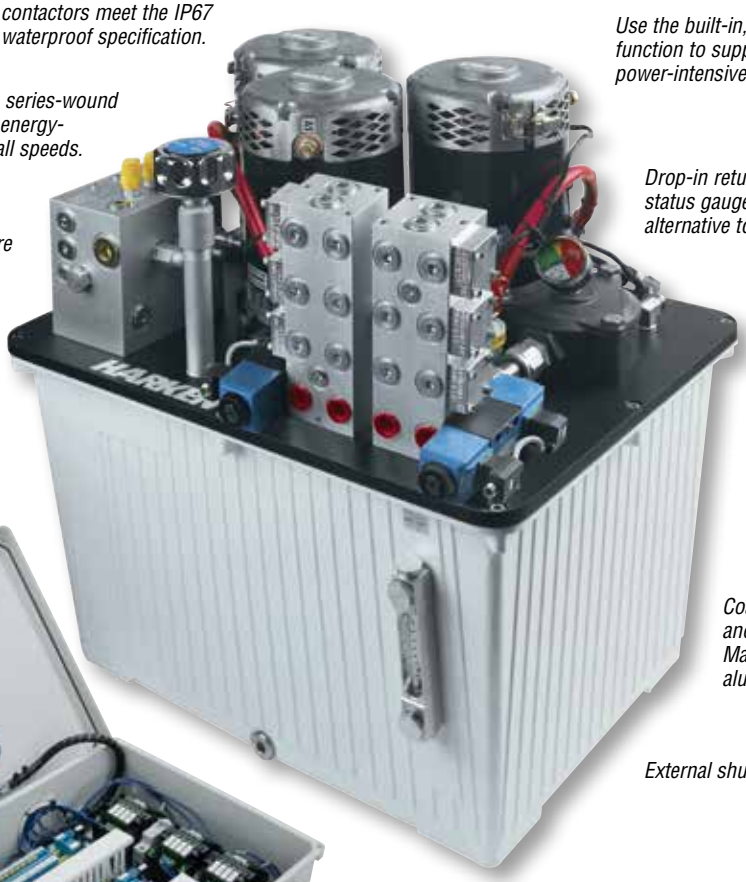
Tank-mounted, electrical motor contactors meet the IP67 waterproof specification.

Use the built-in, double-flow function to supply more oil to power-intensive equipment.

Fan-cooled, series-wound motors are energy-efficient at all speeds.

Drop-in return line filters with status gauges provide a no-mess alternative to typical spin-on styles.

Plumbing to manifolds is under reservoir top so there is no exposed plumbing (not visable).



Hydro 3 (HPU)

Coated aluminum tanks have hardcoat-anodized 6061-T6 aluminum top plates. Manifolds are made with clear-anodized aluminum.

External shut-off switches.

Sealable penetrations into control box provided for deck switch wiring.

Deutsch receptacle and plug connects motor power cables to electronic control box

Prewired and waterproofed control boxes are molded from extremely tough polycarbonate.

Electronic Control Box (ECB)

Manifolds and pumps are preplumbed, saving space, installation time, and additional hardware.

Remote Manifold

Power Unit Selection / Parts

Power Unit Selection

Power unit selection must be based on the flow and pressure requirements for all hydraulic equipment that will operate at the same time. Most HARKEN hydraulic equipment (winches, furlers, etc.) requires a flow of 4GPM/15 LPM, with a maximum operating pressure of 2000 PSI/140 BAR.

To select the correct power unit:

1. Consult the manual for each piece of hydraulic equipment that will be driven by the power unit. Note flow and pressure.
2. Determine which pieces of hydraulic equipment or circuits will be used at the same time (i.e. winch and furler).
3. Compare total flow/pressure required for each piece to table below to select power unit.

HARKEN Hydro Power Units are available in three sizes: Hydro 1, 2 and 3. Each motor/pump combination is rated at 4 GPM/15 LPM with a maximum operating pressure of 2000 PSI/140 BAR.

Hydraulic Power Units

Power unit	Number of functions	Max simultaneous functions	24v DC Motor	Maximum current draw (amps)	Tank capacity gal	Tank capacity l	Maximum continuous output psi@gpm	Maximum continuous output bar@l/m	Weight Without manifolds lb	Weight Without manifolds kg	Weight With attached manifolds lb	Weight With attached manifolds kg	Fasteners
Hydro 1	4	1	1 x 4000 Watt	210	7.9	30	2000 @ 4	140 @ 15	89	40.5	102	46.1	M10
Hydro 2	9*	2**	2 x 4000 Watt	2 x 210	18.5	70	2000 @ 8	140 @ 30	182	82.6	194	88.2	M10
Hydro 3	15*	3**	3 x 4000 Watt	3 x 210	18.5	70	2000 @ 12	140 @ 45	233	105.9	246	111.4	M10

*One function delivers double flow output (8 gpm) using 2 motors **This number is reduced by one when a double flow function is in use.

Wiring to Connect Valves to Electronic Control Box
(1 Cable per Valve)

Hydraulic Power
Unit (HPU)

Electronic Control
Box (ECB)

Included with Unit

1. Hydraulic Power Unit (HPU)
2. Electronic Control Box (ECB)
3. Electric Wiring Cables with Terminals
   - 2 Cables per motor to connect power unit motor to ECB
   - 1 Cable per valve to connect power unit to ECB
4. Remote Manifold

You must Supply

Suitable Hydraulic Hoses (See pg. 9)
Switches
Battery Cable with Suitable Fuses
HPU Mounting Bolts – Four (4) M10
Depth of Threaded Holes in Tank Bottom – 15 mm
ECB Mounting Bolts – Four (4) M6 or 1/4"
Mounting Pad to Secure Power Unit to Boat (See pg. 8)
Hydraulic Oil (See pg. 15)
Flow Control Valves If Required (See pg. 9)
Pressure Reducing Valves If Required (See pg. 9)
Pressure Relief Valves If Required (See pg. 9)

Important Safety Information

Read all instructions carefully and follow all safety precautions to avoid personal injury or property damage during system operation. Harken is not responsible for damage or injury resulting from unsafe product use, lack of maintenance or incorrect product and/or system operation. Contact Harken with questions regarding safety precautions and operations. If you lack training on hydraulic safety, consult a hydraulic distribution or service center for a hydraulic safety course. Failure to comply with the following cautions and warnings could result in equipment damage and personal injury.

Symbols and Safety Statements Used in this Manual

Symbols and safety statements have been placed throughout this text to call attention to special information that may affect the equipment and/or the equipment operator. Following is an explanation for your reference.

DANGER! This symbol alerts you to hazards that cause death or serious injury.

WARNING! This symbol alerts you to potential hazards that may kill or hurt you and others if you don't follow instructions.

CAUTION! This symbol alerts you to potential hazards that may damage equipment or void product warranty.

IMPORTANT! Identifies condition or task requiring special attention.

Safety

Safety Requirements

The instructions provided with this manual are for installation and use only. The HARKEN Power Unit must only be serviced by a qualified hydraulic technician. For repair service, contact HARKEN to find the repair site nearest you.

WARNING! Strictly follow all instructions to avoid an accident, damage to your vessel, personal injury or death. See www.harken.com/manuals for additional safety information.

- Always wear eye protection.
- Make sure all components are rated for the maximum system pressure. Hose and fittings generally have a 4:1 safety factor. In static applications, these safety factors are normally reduced to 2:1. Special care should be used in selecting the proper products for these systems. There is a correlation between cost of components and their quality.
- Do not exceed equipment ratings. Overloading causes equipment failure and possible personal injury.
- Never set the relief valve pressure higher than the maximum rated pump pressure. Doing so may result in equipment damage and/or personal injury.
- System operating pressure must not exceed the pressure rating of the lowest rated component in the system. If in question, install pressure gauges in the system to monitor operating pressure. They are your window to what is happening in the system.
- Keep hydraulic equipment away from flames and heat. Excessive heat will soften packings and seals, resulting in oil leaks. Heat also weakens hose materials and packings. For optimum performance, do not expose equipment to temperatures of 65°C [150°F] or higher.
- Use caution when searching for leaks, cracks, kinks or other damage. Serious injury can occur to hands or face from pressure build-up or heated fluids.
- Do not handle pressurized hoses. Escaping oil under pressure can penetrate the skin, causing serious injury. If oil is injected under the skin, seek immediate medical attention.
- Relieve system pressure before servicing or replacing hose lines.
- Never remove a hose line from a pressurized motor or cylinder.
- Avoid hydraulic hose damage. Avoid sharp bends and kinks when routing hydraulic hoses. Using a bent or kinked hose will cause severe back-pressure. Sharp bends and kinks will internally damage the hose leading to premature hose failure.
- Route hose assemblies so that all bends are directed away from the operator.
- Do not drop heavy objects on hose. A sharp impact may cause internal damage to hose wire strands.
- Applying pressure to a damaged hose may cause it to rupture.
- Do not lift hydraulic equipment by the hoses or swivel couplers. Use the carrying handle or other means of safe transport.

Installation

While unpacking the hydraulic power unit (HPU) and electronic control box (ECB), inspect for irregularities. During transport the power unit may have been exposed to many unusual conditions. If irregularities appear, document details and contact shipper and HARKEN distributor.

Plan Installation

Mounting is required for both the HPU and the ECB. Because this installation is on a boat, the following are some points to consider when choosing the installation location:

Location in Boat

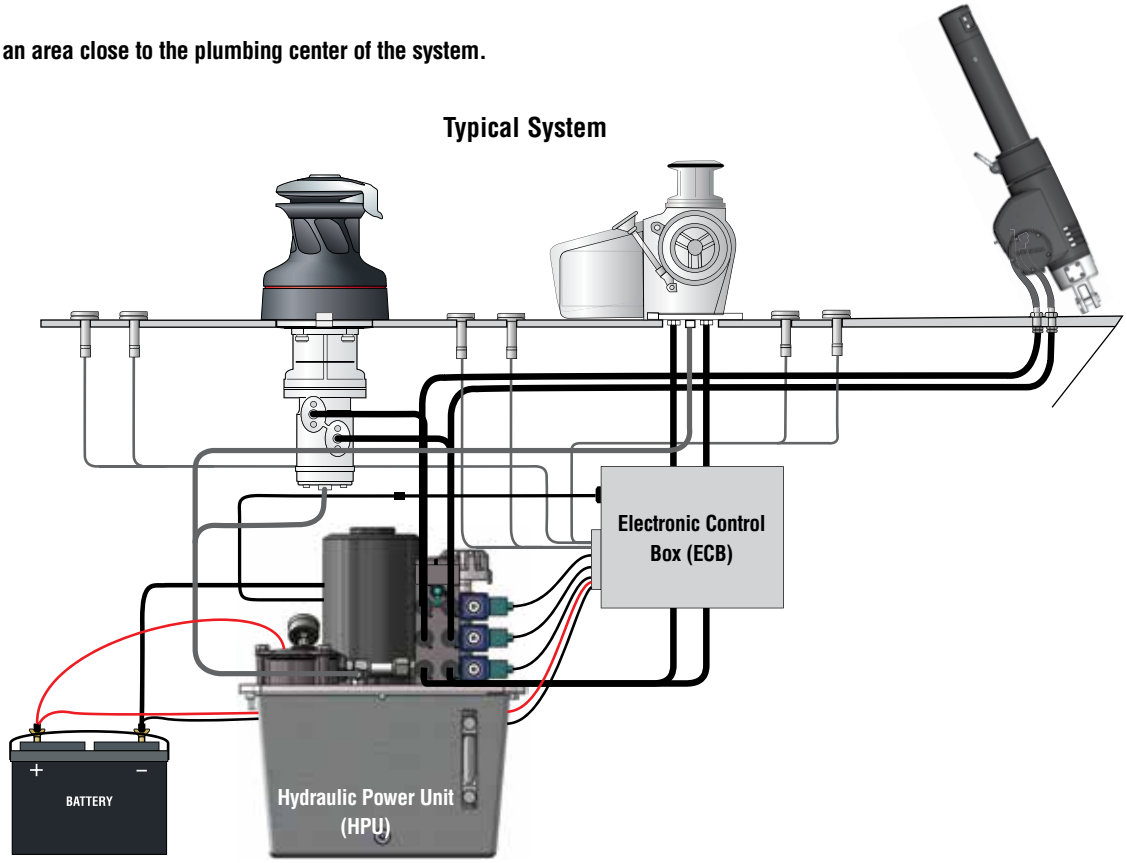
- Dry and well-ventilated, typically near the engine room.
- HPU and ECB to be mounted within close mutual proximity, recommended maximum 5 m wire run. (See Electrical Installation, pg. 12)
- Provide necessary clearance for HPU.
- HPU in close proximity to battery and power supply to reduce voltage drop. (See Electrical Installation, pg. 12)
- Provide access for maintenance and servicing. Make access available to filler tube, filter, filter status indicator and site gauge.
- Central to the system as illustrated in " Typical System" diagram.
- Provide routing for hydraulic hoses from HPU to functions. Hoses attach to manifold horizontally.
- Nearest boat's centerline in an upright position to reduce the heeling extremes.

Attached manifold

Filler tube

Choose an area close to the plumbing center of the system.

Typical System

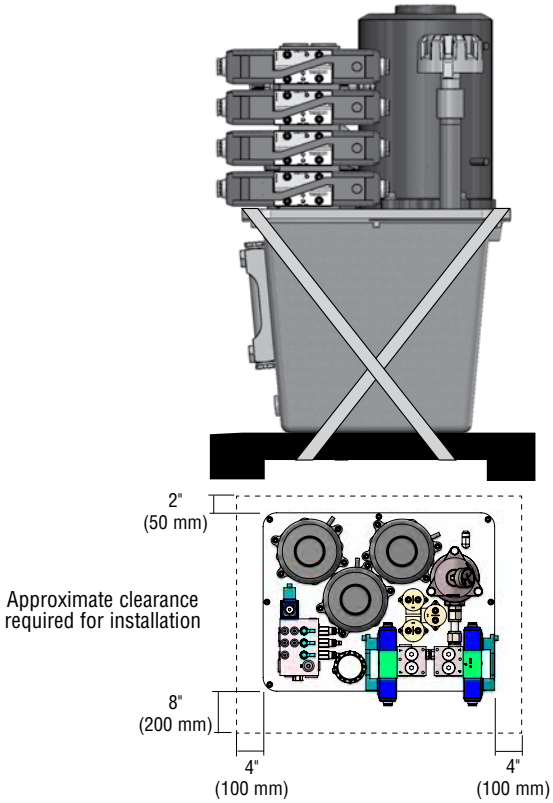


Securing Hydraulic Power Unit

CAUTION! The HPU was shipped cleaned and tested. HARKEN strongly recommends against disassembly or removal of the tank lid or the HPU components. Introduction of contaminants can cause operational problems and possibly void warranty.

A mounting pad with tie downs will be required for securing the HPU to the boat. Every installation is unique. Considerations for the mounting pad and tie downs follow:

- The mounting pad (not supplied) may be a tray, platform or bridge that securely attaches to the boat and supports the HPU. Consider total weight and overall dimensions. (See Technical Data, pg. 20).
- The HPU is fastened using four (4) M10 – 1.5 x 15 mm bolts which thread into the underside of the HPU tank. Underside access must be available for fastening.
- Additional tie down supports (not supplied) are required. These may be similar to battery box tie downs and fabricated from nylon or polyester webbing. Tie downs should attach to the mounting pad and be lashed over the HPU tank as illustrated.



Mount Control Box

Choose a suitable location for the electronic control box (ECB) as described in the planning section.
The ECB is (L) 16.75" (425 mm)x (W) 12" (305 mm) x (H) 6.7" (169 mm) and is externally mounted using four (4) M6 (¼") fasteners. The ECB is water resistant to IP67; however, its location should be dry and within a 5 m wire run to the HPU. Power supply cables and deck switches connect to ECB. (See Electrical Installation, pg. 13).

CAUTION! Cleanliness is crucial for any hydraulic system. Contamination is the primary cause of seal failure. Most hydraulic hoses contain manufacturing debris when purchased. Attaching a dirty hose will contaminate the system. Always flush hoses thoroughly before use. Failure to do so may void warranty.

Measure Hose Run

Measure hydraulic hose runs after the HPU has been mounted. Remember these important points when measuring runs:

- Short straight runs between HPU and function are best.
- Avoid sharp edges which may chafe the hose.
- Minimize fittings/connections throughout the run to avoid possible leak points.
- Minimize 90° bends, which increase system losses and decrease performance. If unavoidable use a 90° swept fitting, do not use a 90° elbow fitting.

Use a swept hose fitting for a 90° bend

Avoid using an elbow

CAUTION! Do not exceed the manufacturer specified minimum bend radius.

Hose and Fitting Selection Recommendation

Functions must be connected to the HPU manifold using proper hydraulic hose size and type. Required hose type is SAE 100 R2 or SAE 100 R8. Hose size is determined by flow and run length between HPU and function.

When ordering, specify that all hoses are flushed, filled with clean oil and capped at point of purchase. In most conditions, HARKEN recommends ISO 46 grade oil*. (See Oil Equivalent Table, pg. 15) If hoses are shipped, they may not contain oil. HARKEN can supply flushed, clean, empty hoses if ordered when purchased.

*exception noted in Hydraulic Oil section, pg. 15.

Recommended Hose ID for Hose Lengths Under 40' (12 m)

	gpm	lpm		in	mm
Single Flow Case Drain				1/4	6.3
Double Flow Case Drain				3/8	10
Triple Flow Case Drain				1/2	12.5
Single Pump/Motor Function	4	15	Supply	3/8	10
			Return	1/2	12.5
Double Pump/Motor Function	8	30	Supply	1/2	12.5
			Return	5/8	16
Triple Pump/Motor Function	12	45	Supply	5/8	16
			Return	3/4	19

IMPORTANT! Always ensure pressure rating for selected hose is equal to or greater than 2000 psi/140 bar.

Hose Shortening

Hydraulic hoses typically shorten 2% to 4% of total length when pressurized. When routing and measuring hose lines, ensure extra hose length is added to compensate for the hose shortening under pressure.

End Fittings

Hydraulic fittings vary widely. HPU manifold A and B ports are -8 SAE female. P and T ports are -10 SAE female. The case drain is -8 JIC male. Hose end fittings may be selected to fit existing function fittings, or function fitting may be replaced. Refer to individual function manuals for specific A&B and drain port sizes.

Fitting Instructions

End fittings must be installed using proper tools by qualified persons. Fittings should be stainless steel whenever possible.

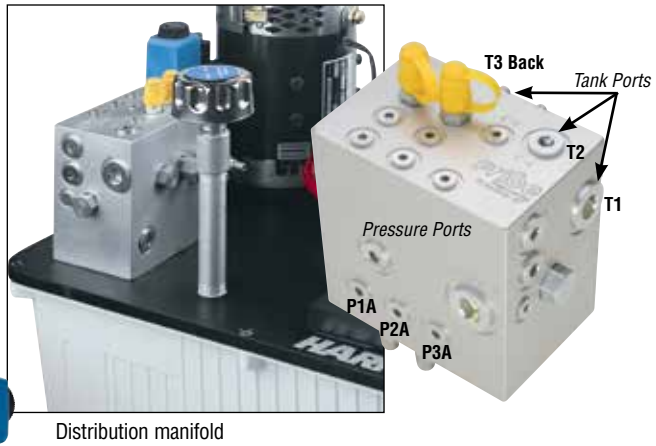
CAUTION! Cadmium plated fittings rust in saltwater environment. Replacement costs outweigh initial cost advantages.

Port Indentification

Hydro 3: HPU has two (2) attached manifolds, each with four (4) valve ports. It also comes with a remote manifold containing up to four (4) valve ports. HPU remote manifold attaches via hose to pressure ports on distribution manifold.

Attached manifold on Hydro 3 HPU

Remote manifold



Distribution manifold

Configuration

The stock configuration of Hydro 3 is internally plumbed such that valves are pre-assigned to a manifold and motor. This is illustrated in the Function Assignment Table. Hydro 3 unit uses valves 1-4 with manifold 1 and motor 1and valves 6-9 with manifold 2 and motor 2. Valves 10-13 correspond with remote manifold and motor 3. Valve Station 5 is located on the distribution manifold and is used with motors 1, 2 and 3. Valve Stations 14 and 15 can be used with remote manifolds when more multiflow valves are needed.

Function Assignment

The Hydro 3 unit is equipped with two (2) attached manifolds and one (1) remote manifold per design specification. Each manifold style has up to four (4) valve stations corresponding with four (4) ECB switches. Assign each function to its own set of valve ports. Record the function name in the Function Assignment Table below. When assigning valves to functions, be sure to separate functions that will run simultaneously to different manifolds. **Example 1:** Run primary winches on different manifold than mainsheet.

Example 2: Run primary winches on different manifold than headsail furler. Refer to this information when connecting the electric switches. For easy reference, label the hydraulic hoses in accordance with the valve. For example: label Valve Station 1 hoses for your attached manifold "VS1A and VS1B".

Function Assignment Table

Function Name	Valve Station Number	Attached Manifold Number	Remote Manifold Number	Motor
	VS1	A1	—	1
	VS2	A1	—	1
	VS3	A1	—	1
	VS4	A1	—	1
	VS5	D	—	1, 2
	VS6	A2	—	2
	VS7	A2	—	2
	VS8	A2	—	2
	VS9	A2	—	2
	VS10	—	R1	3
	VS11	—	R1	3
	VS12	—	R1	3
	VS13	—	R1	3
	VS14	—	*	1, 2
	VS15	—	*	1, 2, 3
	VS1	—	R1	1
	VS2	—	R1	1
	VS3	—	R1	1
	VS4	—	R1	1
	VS5	—	—	1, 2
	VS6	—	R2	2
	VS7	—	R2	2
	VS8	—	R2	2
	VS9	—	R2	2
	VS10	—	R3	3
	VS11	—	R3	3
	VS12	—	R3	3
	VS13	—	R3	3
	VS14	—	*	1, 2
	VS15	—	*	1, 2, 3

Manifold Blanking Plates

All manifold stations must have either blanking plates or valves. Once all functions have been assigned, attach blanking plates to stations not in use. Tighten #10-24 bolts to 4.1 ft-lb (5.6 N-m) torque. The unit is shipped with the number of valves ordered. Additional valves may be added if blanking plates are present.

Flushing Hoses

Flush hoses prior to connecting to HPU, if not done when purchased. Use an external filtration pump (not included) to remove all debris.

Connecting Hoses

Install hoses per predetermined route.

- If hose end fittings differ, verify mating fittings prior to running the hose.
- Remove plugs from the HPU manifold and function ports to connect A and B hoses.
  To prevent filled hoses from draining, connect the lower of the two ends first. This is typically the HPU.
- Attach the other hose end at the higher connection.
- If case drain hoses are required, continue with the same procedure used on A and B hoses.
- Plug all unused A and B ports to prevent contamination.
  Any unused A and B ports with a valve must be plugged with ORB plugs as well.

IMPORTANT! ORB, BSPP and JIC connections do not need PTFE tape or other sealing.

Case Drains

Function motors with drain ports must be routed to a common case drain on the HPU during the installation. T-fittings may be used to connect multiple drain port hoses to one common hose that leads to the case drain. Line sizing should be based on maximum flow in order to prevent flow restriction and back pressure.

Example: The 3 unit is sized to fully power either three functions or two double flow functions at a time. To allow for free flow back to the HPU, the common case drain hose that combines flow from all drain port hoses must be up-sized.

The recommended minimum hose size for function drain ports should be ¼" inner diameter (ID).

Mounting Clamp Hose Support

Support hoses using mounting clamps to prevent chafing and premature failure. Remember to allow for 2% to 4% shortening when pressurized.

Protect Hydraulic Hose from Sunlight

Sunlight leaches out elastomers causing the cover to weather check or develop cracks deep enough to allow moisture penetration of reinforcement. Use protective hose covers and/or store under protective cover when not in use.

Individual Function Protection

Some equipment may require lower max flow or lower max pressure than the hydro unit can deliver. Use a flow control valve, pressure reducing valve and/or pressure relief valve to reduce maximum flow and/or maximum pressure. These valves are not included with the Hydro 3 unit. They should be purchased as required by the original equipment manufacturer.

Electrical Installation

HARKEN Hydro Units include 24 volt DC motors standard. 12 VDC motors are available by special order.

Electrical installation is intended to be straight forward. For instance, connections internal to the ECB are prewired. At the time of installation the user is only required to make the necessary connections between the switches, valves, ECB, HPU and power supply/battery.

To ease installation, the ECB terminals for switches, valves, 24V power and ground are labeled. For quick reference, terminal and valve port labeling follows a corresponding numbering scheme. For the wires routing from switches on the deck or valves on the manifold, waterproof integrity is maintained by passage through a sealed gland. Electrical installation is divided into five basic steps:

1. Connect the deck switches to the ECB
2. Connect a ECB to power supply
3. Connect HPU motor to the ECB
4. Connect valves to the ECB
5. Connect the HPU to the battery

IMPORTANT! Adhere to electrical standards per the National Boatbuilding Regulatory Bureau.

CAUTION! DO NOT connect the cable from the battery to the HPU until all of the other steps are complete.

CAUTION! Be extremely careful when connecting the battery cables. Short circuiting the battery connections can damage the HPU and/or motor and possibly cause damage to the boat, a fire and/or personal injury.

CAUTION! Never run the HPU pump without oil. This can cause serious damage to the pump and/or motor and will void the HPU warranty.

Wire Selection

Three types of wire cables are required for installation:

1. Wires to connect switches to the ECB.
2. Wires to connect the power supply to the ECB.
3. Wires to connect the HPU to the battery.

Minimize voltage loss on battery and power supply cables by sizing wire gauge for a length of wire. Refer to the Wire Sizing Table below for a given length of wire.

At the HPU motor contactor, the positive terminal is an 8 mm stud, and the common ground terminal is a 10 mm stud. Install end terminals using proper crimping tool.

Wire Sizing Table

	16 ft (5 m)		33 ft (10 m)		49 ft (15 m)	
Switch or Valve to ECB	16 AWG	1.31 mm^2	14 AWG	2.08 mm^2	12 AWG	3.31 mm^2
Power Supply to ECB	12 AWG	3.31 mm^2	10 AWG	5.26 mm^2	8 AWG	8.366 mm^2
Battery to HPU Motor	00 AWG	67.4 mm^2	0000 AWG	108 mm^2	—	—

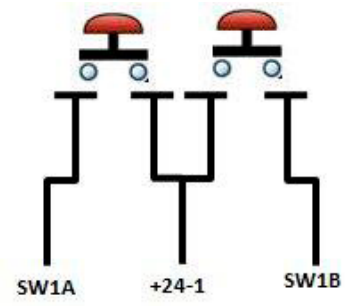
Connect Deck Switches to the ECB

Install the deck switches in a convenient location. By design, two (2) deck switches are used per function. Generally, one switch would actuate the function motor in a forward direction and the other in the reverse. Example: for a furler, the (A) switch would furl and the (B) would unfurl.

Follow these steps to connect deck switches to ECB:

1. Select moisture barrier gland insert.
2. Pass switch wires through gland into the ECB case.
3. Connect deck switch wires per Switch Wiring Table below. Switch wires connect to terminal strip labeled +24 - X and SWXX. (See photo).

Note: For wire gauge information, refer to pg. 12.



Switch Wiring Table

Valve	Switch	Wire 1	Wire 2
1	A	+24 -1	SW1A
	B	+24 -1	SW1B
2	A	+24 -2	SW2A
	B	+24 -2	SW2B
3	A	+24 -3	SW3A
	B	+24 -3	SW3B
4	A	+24 -4	SW4A
	B	+24 -4	SW4B
5	A	+24 -5	SW5A
	B	+24 -5	SW5B
6	A	+24 -6	SW6A
	B	+24 -6	SW6B
7	A	+24 -7	SW7A
	B	+24 -7	SW7B

Valve	Switch	Wire 1	Wire 2
9	A	+24 -9	SW9A
	B	+24 -9	SW9B
10	A	+24 -10	SW10A
	B	+24 -10	SW10B
11	A	+24 -11	SW11A
	B	+24 -11	SW11B
12	A	+24 -12	SW12A
	B	+24 -12	SW12B
13	A	+24 -13	SW13A
	B	+24 -13	SW13B
14	A	+24 -14	SW14A
	B	+24 -14	SW14B
15	A	+24 -15	SW15A
	B	+24 -15	SW15B

Note: *Polarity is not an issue with 2-wire deck switches*

Connect ECB to Power Supply

Follow these steps to connect power to ECB:

1. Prior to making any connection, verify internal 5A circuit breaker is in OFF position and system isolation switch on ECB cover is in OFF position.
2. Pass power supply wires through gland into the ECB case.
3. Connect power supply positive lead to the circuit breaker terminal labeled OCB.
4. Connect power supply common lead to any GND(–) terminal.

Connect HPU Motor and Valves to ECB

Each valve operates using a three wire cable bundle with an M12 connector.

Note: Valve wires supplied are 5M. These can be extended with a 16-gauge wire if needed. (Refer to Wire Sizing Table, pg. 12.)

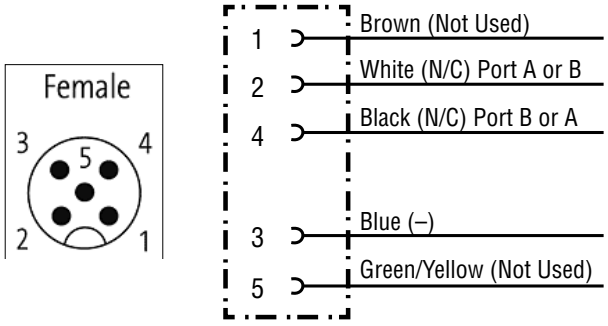
Follow these steps to connect HPU motors and valves to ECB:

1. Join mating ends of Deutsch Connector to connect the ECB to the HPU motor.
2. Pass valve wires through gland into the ECB case.
3. Connect valve wires per Valve Wiring Table at right. Valve wire sets connect to terminal strip labeled SWXA, SWXB and GND(–). (See photo, pg. 13).
4. Connect valve cable to M12 connector on valve.

IMPORTANT! Align key and keyway on connector.

Valve Wiring Table

Valve	Black	White	Blue
1	SW1A	SW1B	Ground
2	SW2A	SW2B	Ground
3	SW3A	SW3B	Ground
4	SW4A	SW4B	Ground
5	SW5A	SW5B	Ground
6	SW6A	SW6B	Ground
7	SW7A	SW7B	Ground
8	SW8A	SW8B	Ground
9	SW9A	SW9B	Ground
10	SW10A	SW10B	Ground
11	SW11A	SW11B	Ground
12	SW12A	SW12B	Ground
13	SW13A	SW13B	Ground
14	SW14A	SW14B	Ground
15	SW15A	SW15B	Ground



Connect HPU to Battery

Follow these steps to connect HPU to Battery:

1. A 250-300A circuit breaker or fuse (not supplied) must be installed between HPU motor and battery. Prior to making connection, remove fuse element or verify circuit break is in OFF position.
2. Connect positive lead from fuse to open 8 mm terminal stud contactor on solenoid switch.
3. Connect from fuse to battery.
4. Connect negative lead from 10 mm stud on motor case to common terminal or (-) battery terminal.

CAUTION! DO NOT close the circuit with the fuse or circuit breaker until the Commissioning phase.

Commissioning

When commissioning hydraulic equipment, it is extremely important to carefully follow each procedure to avoid premature system damage and/or failure. Secure connections, ensure cleanliness, confirm proper fluid levels and perform all recommended tests. The following are instructions to ensure proper commissioning of your Hydro 3.

Filling Reservoir

Pump hydraulic oil through an adequate filter into reservoir. Fill until oil level indicator is 2/3 - 3/4 full. Inspect for leaks. Reservoir capacity is 70 liters (18.5 gal.). Approximately 55 liters (14.5 gal) will be needed for the reservoir. If installation is completed with empty hoses, extra oil will be needed to meet the 2/3 - 3/4 tank fill indicator requirement.

Oil Level Indicator

Filler Tube

Hydraulic Oil

HARKEN recommends mineral-based, ISO 46 grade oil. Refer to Oil Equivalent Table below. If HPU is primarily used in an extreme cold weather environment, ISO 32 is suitable.

Characteristics of good quality, mineral-based hydraulic oil are:

- Good anti-wear performance
- Resistance to oxidation depredation
- Protection against rust and corrosion
- Resistance to foaming
- Ability to separate water rapidly
- Suitable for widely varying temperature conditions
- Good low temperature flow properties
- Retains viscosity/temperature characteristics while in service
- Universally available

Note: If the hydraulic installation was completed with empty hoses, be sure to have extra oil on hand to top off the tank as the hoses are filled.

CAUTION! Never run the HPU pump without oil. This will void warranty.

Oil Equivalent Table

Manufacturer	Brand Name	Manufacturer	Brand Name
Amoco®	Rykon 46	**Gulf®**	46AW
Ashland Valvoline®	Evergol 46	**Mobil®**	DTE 20 Series 25
Atlantic Richfield®	Duro AW-S-215	**Mobil®**	DTE 10 Series 19
BP	Energol HLP	**Pennzol®**	Magnus A 315
Chevron® USA	AW Hydraulic Oil 46	**Phillips Petroleum® Corp.**	Tellus 46
Citgo® Petroleum Corp.	A/W Pacemaker XD-46	**Shell®**	Tellus T46
Citgo® Petroleum Corp.	A/W 46	**Shell®**	SUNTAC WR 150 WR
Conoco® (Continental)	Super Hydraulic Oil 21	**Texaco®**	Rando HD 46
Esso®	Nuto H46	**Union®**	Hydraulic Oil Unax AW 215
Exxon®	Nuto H46		

Registered trademarks: Amoco® - Amoco Oil Company: Ashland Valvoline® - Ashland, Inc.; Atlantic Richfield® - Atlantic Richfield Co.; BP® - BP p.l.c; Chevron® USA - Chevron Intellectual Property LLC; Citgo® Petroleum Corp. - Citgo Petroleum Corp.; Conoco® (Continental) - ConocoPhillips; Esso® and Exxon® - ExxonMobil; Gulf® - GULF Oil International; Mobil® - ExxonMobil; Pennzoil® - SOPUS Products; Phillips Petroleum® Corp. - Phillips 66; Shell® - SOPUS Products; Texaco® - Chevron Intellectual Property LLC: Union® - Phillips 66.

Closing Circuit

Verify the system installation after completing hydraulic and electrical installation and filling the reservoir. To begin closing the electrical circuit:

1. Flip internal ECB circuit breaker to ON position.
2. Install fuse element between HPU motor and battery cable or flip circuit breaker to ON position.
3. Flip system isolation switch on ECB cover to ON position.

Leak Check

To perform leak check, run one function at a time in a single direction for 5 – 10 seconds. If installation was completed with empty hoses, increase the run time to 10 – 30 seconds. Perform the following:

1. Confirm hose run is correct by verifying operation of intended function.
2. Inspect each fitting for leakage.

CAUTION! If leak is present, decrease system pressure to 0 psi before tightening fittings.

3. Tighten fitting as necessary.
4. Repeat procedure for all functions.

IMPORTANT! If installation was completed with empty hoses, check the oil level indicator after each function, and add oil as necessary

One-Way Function Flush

Flush the function motor through the system filter by running each function in a single direction. Run in same direction as previous step. This process helps ensure system cleanliness by depositing any contaminates into the system filter. Refer to Run Time Table. Total length is sum of A and B hose. Repeat procedure for all functions.

Run Time Table

Hose size		Run time per 10' (3 m) of Hose
in	mm	sec
3/8	10	5
1/2	12.5	7.5
5/8	16	10
3/4	19	15
1	25	25

System Validation

Verify proper function performance and correct switch wiring by running one function at a time first in one direction and then in the other direction.

Single direction functions, i.e. single speed winch, are operated by one deck switch. If function does not operate per specific user manual, switch wiring may be incorrect, or A and B hoses may be reversed. If this is the case refer to the Hydraulic and Electrical Installation sections and verify each step.

Two direction functions, i.e. furlers, two- and three-speed winches are operated by two deck switches. Each switch operates one direction. Verify each switch operates the intended function direction. If not, either reverse switch wiring at terminal strip inside the ECB, or reverse A and B hoses. For more specific operational instructions refer to specific function user manual.

Function Pressure Check

Refer to each function's user manual for maximum flow, maximum pressure and function working load before operation under stated condition.

CAUTION! To avoid equipment damage, DO NOT exceed function's maximum pressure or maximum flow. DO NOT exceed the safe working load of any function.

Carefully load system and verify function operates per specific user manual. During function operation, inspect hoses for chafing or binding. With pressure at zero, inspect fittings for leaks. Ensure proper safety precautions are practiced to avoid personal injury due to pressurized oil.

CAUTION! If leak is present, decrease system pressure to 0 psi before tightening fittings.

Oil Level and Filter

Maintain an oil level of 2/3 - 3/4 full as viewed through tank fill indicator.

Most foreign particles flush into the return filters after first few hours of operation. If system was exposed at any time to possible contamination, replace filter element.

If you have any questions, contact your HARKEN Tech Service Representative.

Power Up / Power Down

HARKEN Hydro Power Units have system isolation switches on the electronic control box.

During short-term, inactive periods the system isolation switch should be in OFF position. This deactivates deck switches.

For long-term storage, in addition to placing isolation switch in OFF position, remove the fuse or circuit breaker between HPU motor and battery.

Oil Level

Maintain an oil level of 2/3 - 3/4 full as viewed through Oil Level Indicator. Always inspect oil level before use. If necessary to maintain proper level, add more filtered oil to tank.

Motor Thermal Protection

HARKEN standard Hydro Power Units feature a 4kW 24VDC series wound motor. (12VDC motor available by special order) Motors are specified to provide years of service under standard operating conditions.

Due to high current draw, these motors will generate excessive amounts of heat after extended periods of operation at load. To avoid motor damage, the motor is equipped with an internal thermal monitor and switch.

The motor is sized to run a minimum of five (5) minutes without tripping the thermal switch. If overheating occurs and the thermal switch is tripped, an indicator light on ECB will illuminate. After this occurrence, the motor requires a variable cooling period based ambient conditions.

Electronic Control Box (ECB)

Oil Level Indicator

Internal Thermal Switch Override

IMPORTANT! In case of emergency, thermal switch override is located inside the ECB. Flip toggle switch to engage override. Once thermal switch override is engaged, motor will operate until it stalls. If thermal switch override is engaged, HPU warranty may be voided.

CAUTION! Motor operation beyond temperature limits will cause damage to motor and possibly other components.

Single- and Multiple-Function Operation

The Hydro 3 is designed to operate either three single-flow functions on different manifolds or two double-flow functions at a time. All functions are powered by either one or a combination of two motors. If additional functions are operated simultaneously, oil flow will be divided among all functions and performance across all operating functions will decrease.

Maintenance

HARKEN Hydraulic Power Units will provide years trouble free operation with proper, routine maintenance. Adherence to a maintenance schedule will lengthen component life, reduce downtime, and minimize repair costs. Typical maintenance includes regular oil changes, replacing filter elements, oil sampling and component inspection. Under normal operating conditions, the following maintenance schedules are suggested:

Oil Filter Status Indicator

Filter Element Replacement Schedule

- Within eight (8) operating hours after the initial commissioning
- Every 500 operating hours or when Oil Filter Status Indicator signals a dirty filter
- During any complete oil change

Filter supplied with the unit is a drop-in element (HYFEH10). Ensure O-rings are fitted into ends of filter prior to installation. Contact HARKEN for replacement elements. If using other manufacturer, cross-reference the filter and use element rated for 10 micron or better.

IMPORTANT! Oil filter status indicator functions only when unit is powered and when motor and pump are running. In operating conditions with high levels of airborne particles, inspect breather at frequent intervals.

CAUTION! If necessary, top off oil reservoir using proper fluid type. Do not mix oil types. Refer to Oil Equivalent Table, pg. 15. Only use filter elements capable of meeting or exceeding the oil cleanliness level requirements.

Hydraulic Oil Change Schedule

- After first 500 operating hours
- Every 1000 operating hours or biannually regardless of accumulated operating hours
- Oil change interval lengths can be adjusted (longer or shorter) if results of laboratory fluid sampling and oil analysis reveal oil is cleaner or more contaminated than expected at 1000 operating hours.

IMPORTANT! Conduct recommended oil change schedule in accordance with fluid type, aging, and oil contamination level. Oil condition depends on moisture content and additive level. In operating conditions with high levels of airborne particles and/or elevated thermal loads, reduce intervals between oil changes should be reduced accordingly.

How to Change Oil

Oil change intervals are recommended based on various factors such as the type of fluid, the degree of aging and the contamination of the oil. Water content and the levels of additives are also significant factors in determining the condition of the oil. Important guidelines to remember are:

- Follow proper procedures when changing oil. Improper cleaning procedures may contaminate hydraulic system.
- Perform oil changes in a warm operating environment.
- Drain old oil before adding new. Reservoir may be emptied via one of two methods:
    1. Place basin near HPU beneath drain plug. Remove plug and let oil drain into basin until reservoir is empty.
    2. Use siphon/oil pump method to pull oil up through hose in filler tube. Use a basin to collect oil.
- Once oil is drained, use lint-free rags to clean reservoir. Remove debris prior to refilling.
- Filter oil prior to filling reservoir. Never fill a reservoir through a filler breather without filtering it prior to or during the filling process.
- Take care to not introduce contaminates from the filter housing when removing filter.

Note: Always dispose of oil properly. Contact your local waste authority, and follow guidelines for recycling and/or disposal.

CAUTION! Filter oil prior to filling the reservoir. Cleanliness of oil directly from barrel is not sufficient for system operation. Contact local hydraulic service company for filter carts or pre-filtered oil.

Problems occurring during oil change result from:

- Use of unsuitable hydraulic oil
- Use of oil which was contaminated due to faulty storage
- Failure to clean reservoir
- Inadequate cleanliness when filling, i.e. dirty drums or containers
- Filling to improper levels

Maintenance

Leakage Inspection

After commissioning visually inspect system for leaks. Perform visual leak inspection at regular intervals. It is good practice to visually inspect for leaks prior to every use.

CAUTION! If leak is present, decrease system pressure to 0 psi before tightening fittings.

Cleanliness Inspection

Maintain a dirt-free system. This is very important in applications in environment with a high degree of airborne contaminants. Leak detection is easier and quicker on clean system.

Oil Level Inspection

Check oil level every 2 to 4 hours during the first day of use. Check oil level twice a day during first week and once a week thereafter.

CAUTION! If necessary, top off oil reservoir using proper fluid type. Do not mix oil types. Refer to Oil Equivalent Table, pg. 15.

Additional Maintenance Points

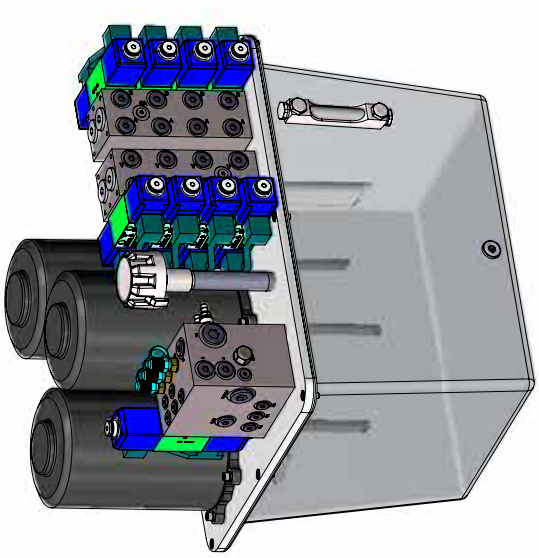
- Always power down HPU prior to performing maintenance.
- Place a label or tag on HPU indicating type of fluid that is installed.
- Replace any hoses that appear to be worn or chafed.

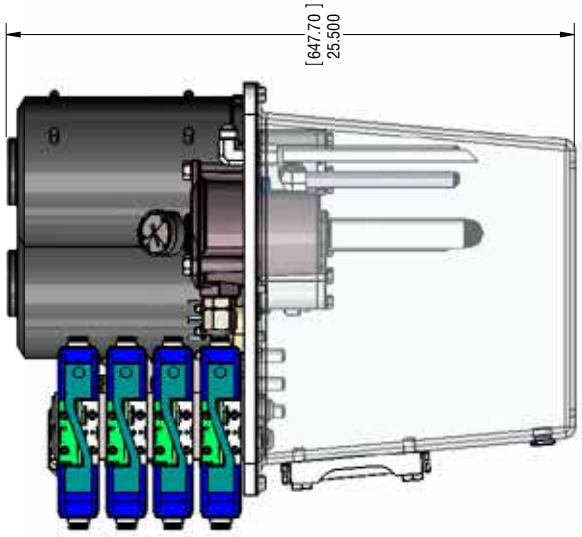
Troubleshooting

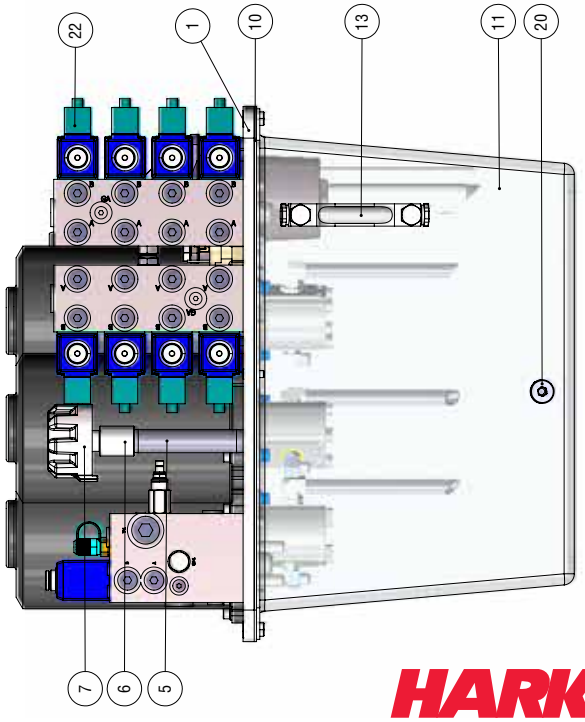
Problem	Possible Cause	How to Verify
None of the functions are working	No electrical power	Check power to ECB
		Check motor switches on ECB
		Check wiring from ECB to motor
		Check main circuit breaker to ECB
		Check lights on micro circuit breaker. If red, reset circuit breaker.
	Motor is not operating	Check thermal switch trip light on ECB
		Verify proper voltage at motor
		Verify operation of motor relay
	Motor is stalling	Pressure relief valve not working
		Not enough current going to motor
	Pump is not operating correctly	Check oil level in reservoir
		Repair pump
Single function is not working	Function is turned off	Check function breaker in ECB
	Switch is not working	Check wiring from deck switch to ECB
	Valve is not working	Check wiring from ECB to directional valve
		Check lights on micro circuit breakers. If red, reset circuit breaker.
		Check operation of directional valve solenoids
		Perform manual override with hex wrench
Functions are running slow	System leak present	Check hose and fitting connections
	Reduced motor speed	Verify adequate battery voltage to motor
	Relief valve is opening	Hydraulic line is plugged
	Pump flow is reduced	Check oil level in reservoir
	Filters are plugged	Check filter status gauge. Replace filter element if needed.
Function load reduced	System leak present	Check hose and fitting connections
	Insufficient motor torque	Verify batteries are fully charged
	Relief valve is opening	Check relief valve opening pressure
	Pump is not operating correctly	Check oil level in reservoir
		Check system pressure under load

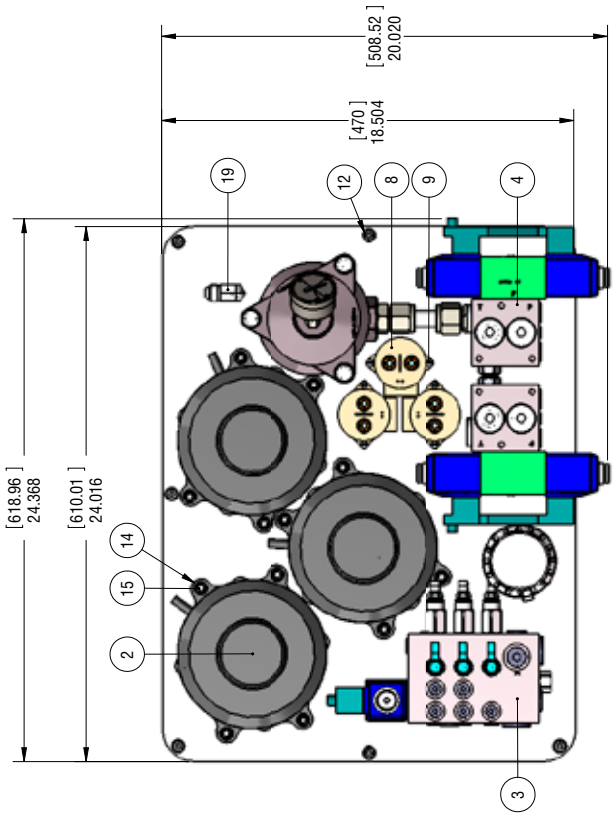
Bill of Materials

NO.	QTY.	DRAWING NO.	PART NO.	MATERIAL	DESCRIPTION
1	1	H-51335	-	H-51336 BLANK	TANK TOP
2	3	H-50915	-	VARIOUS	HYDRO PUMP/MOTOR ASSY
3	1	H-52505	-	VARIOUS	HYDRO 3 - DISTRIBUTION MANIFOLD ASSY
4	1	H-52508	-	VARIOUS	HYDRO- UNIT 2&3 MFLD AND FILTER ASSY
5	1	H-52564			HYDRO- 3/4in NPT MALE-MALE AL PIPE NIPPLE X 6in
6	1	H-52565			HYDRO- 3/4 NPT FEMALE-FEMALE ALUMINUM COUPLER
7	1	H-52566			HYDRO- EATON MALE NPT FILL MBR110
8	3	H-51191			SOLENOID SWITCH 12-24V
9	6	H-52567	HFS259		10-32 X 1.25 SS SL RH
10	1	H-52602	-	-	HYDRO - 70L TANK GASKET
11	1	H-51470		CAST ALUMINUM	FINISHED AB 70 ALUMINUM HYDRO TANK
12	8	H-38261A	HFS336	A4 (316) SS	M8 X 1.25 X 16 SHCS
13	1	H-52568	-	-	HYDRO- 5in SIGHT LEVEL GAUGE
14	22	H-52521	HFS 232	SS	5/16 SS LOCK WASHER
15	22	H-52522	HFS568	18-8 SS	FST-5/16-18X1.00 18-8 SHCS
16	1	H-52619	-	VARIOUS	HYDRO - -12 HOSE - TANK LINE
17	3	H-52606	-	VARIOUS	HYDRO - -6 HOSE - PUMP TO DIST. MANIFOLD
18	2	H-52607	-	VARIOUS	HYDRO - -6 HOSE - MANIFOLD SUPPLY
19	1	H-52623	-	VARIOUS	HYDRO - CASE DRAIN ASSY
20	1	H-53305	HYZPSG8	316 SS	HYD FIT PLUG SS G1/2A BSPP
21	1	H-53545	-	-	WIRING KIT
22	9	H-50229	--	VARIOUS	VALVE: D03, FLOATING CENTER, 24VDC

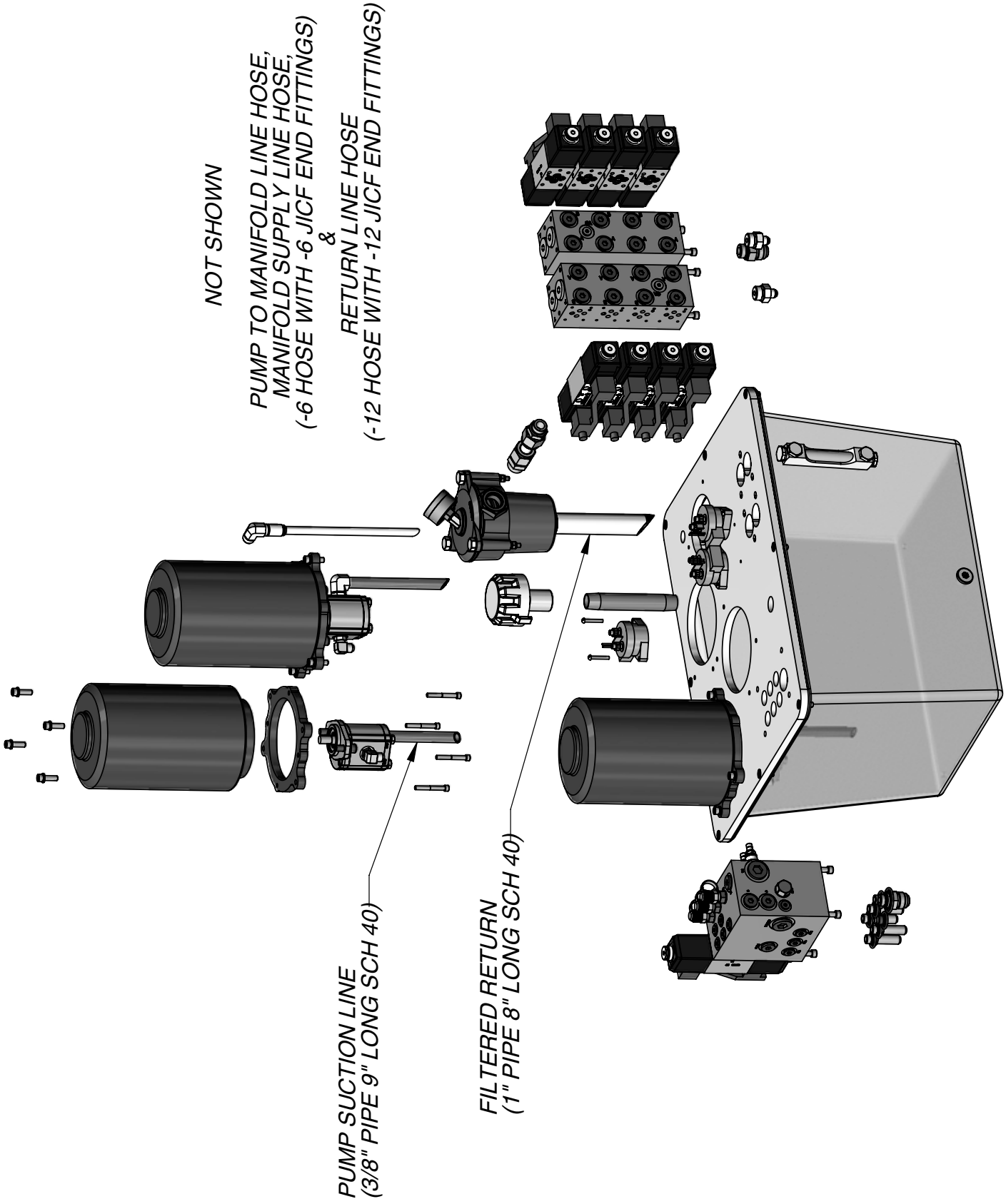




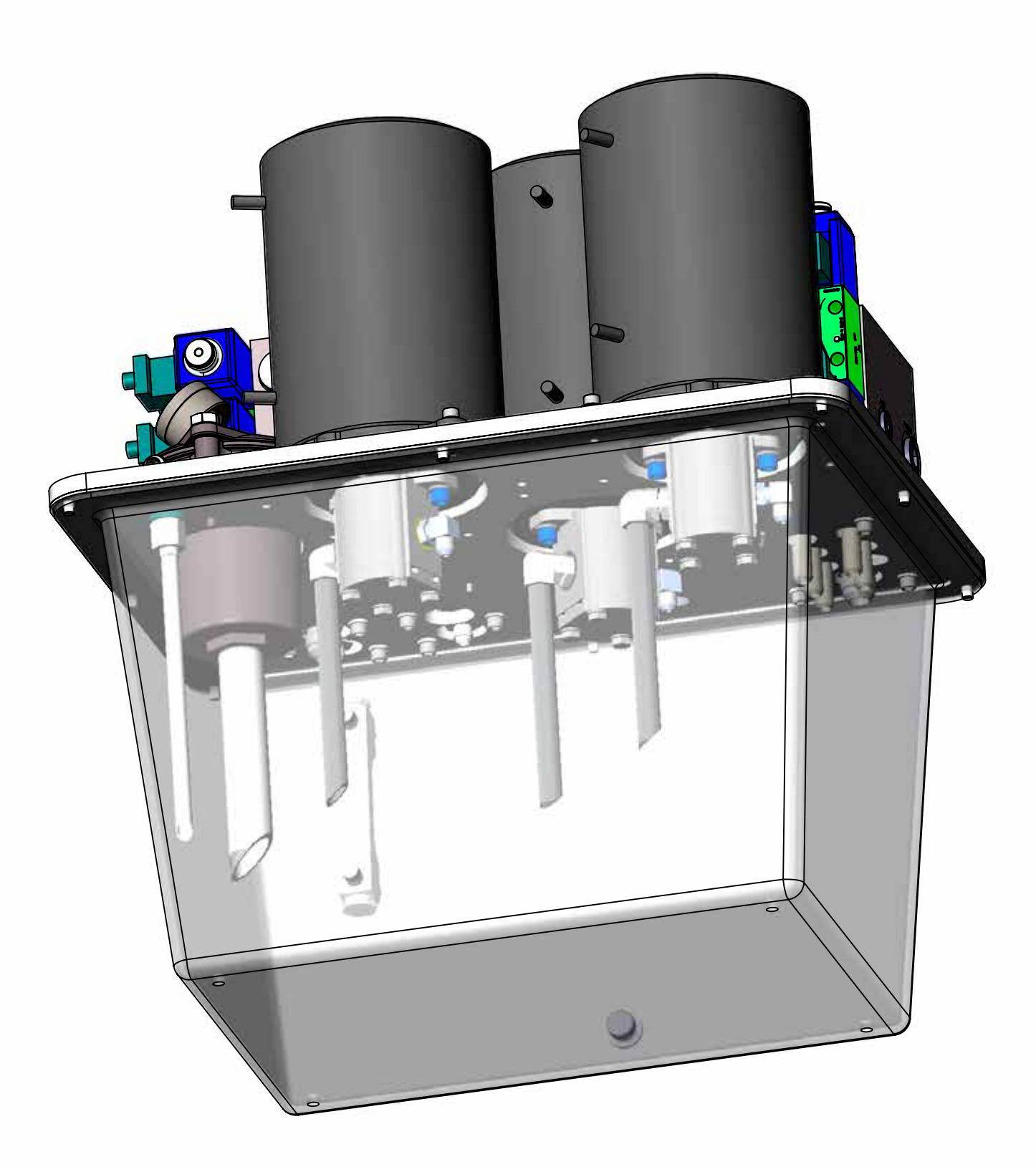


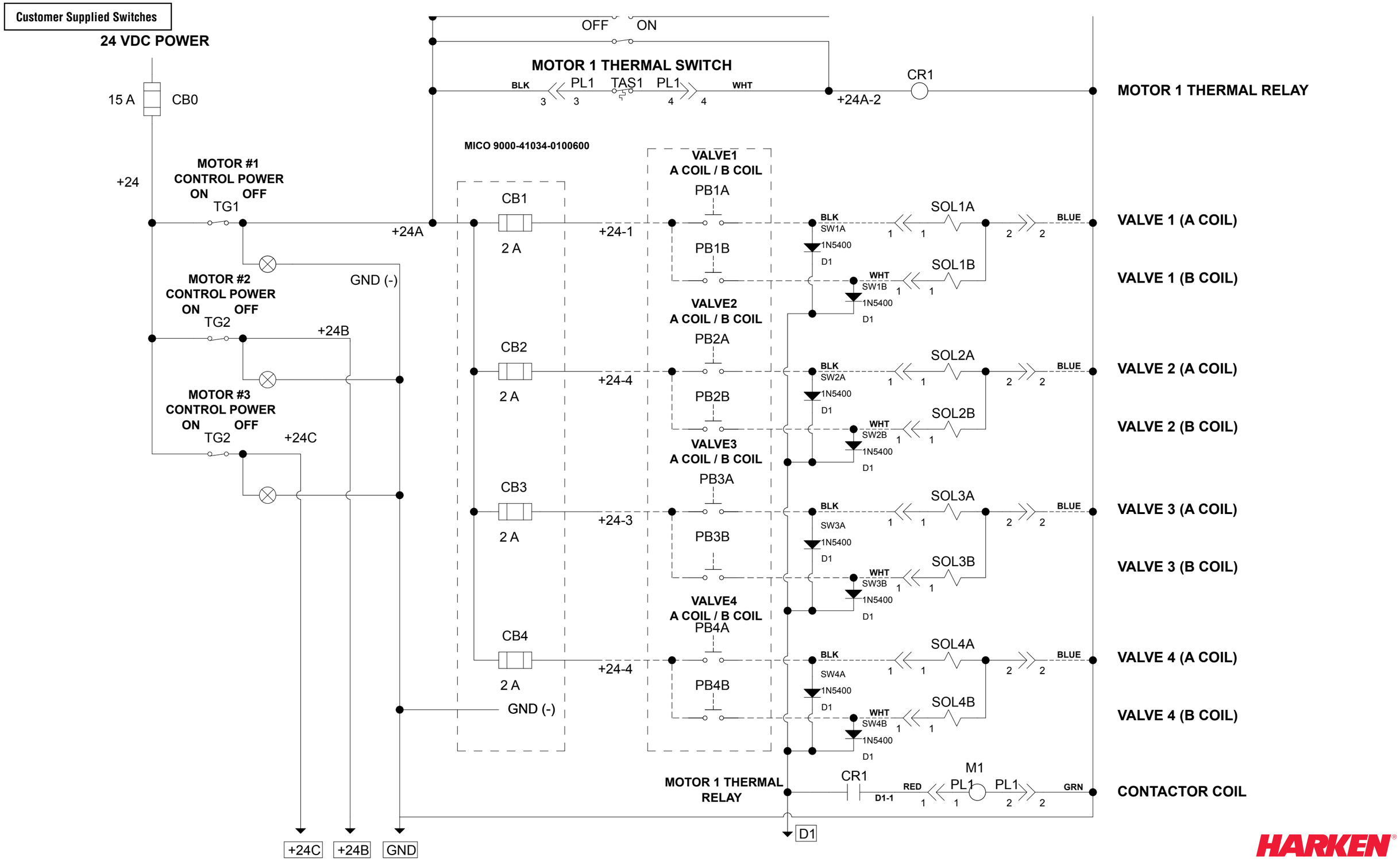


Exploded View Diagram

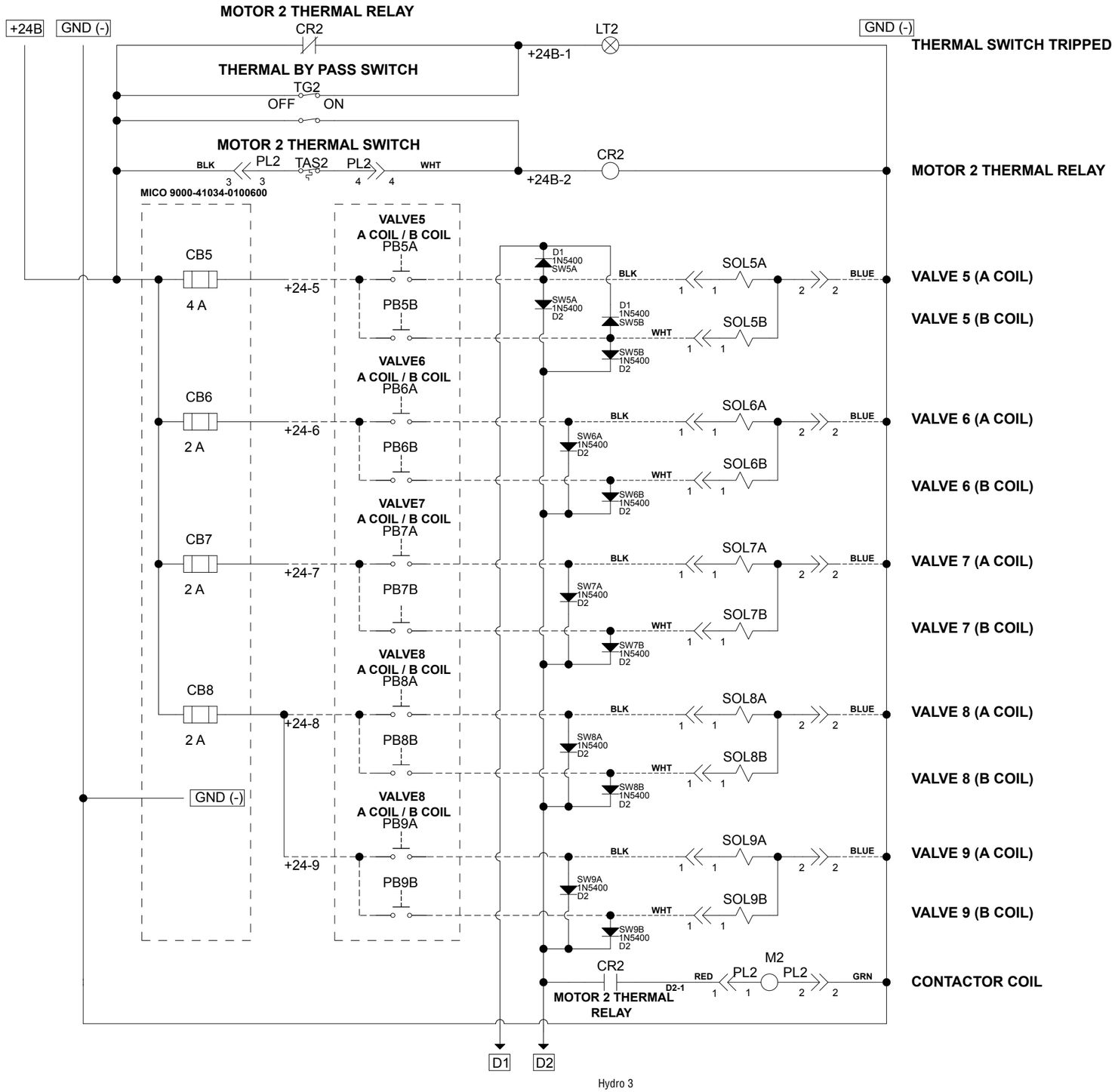

NOT SHOWN
PUMP TO MANIFOLD LINE HOSE,
MANIFOLD SUPPLY LINE HOSE,
(-6 HOSE WITH -6 JICF END FITTINGS)
&
RETURN LINE HOSE
(-12 HOSE WITH -12 JICF END FITTINGS)
PUMP SUCTION LINE
(3/8" PIPE 9" LONG SCH 40)
FILTERED RETURN
(1" PIPE 8" LONG SCH 40)

3D Rendering

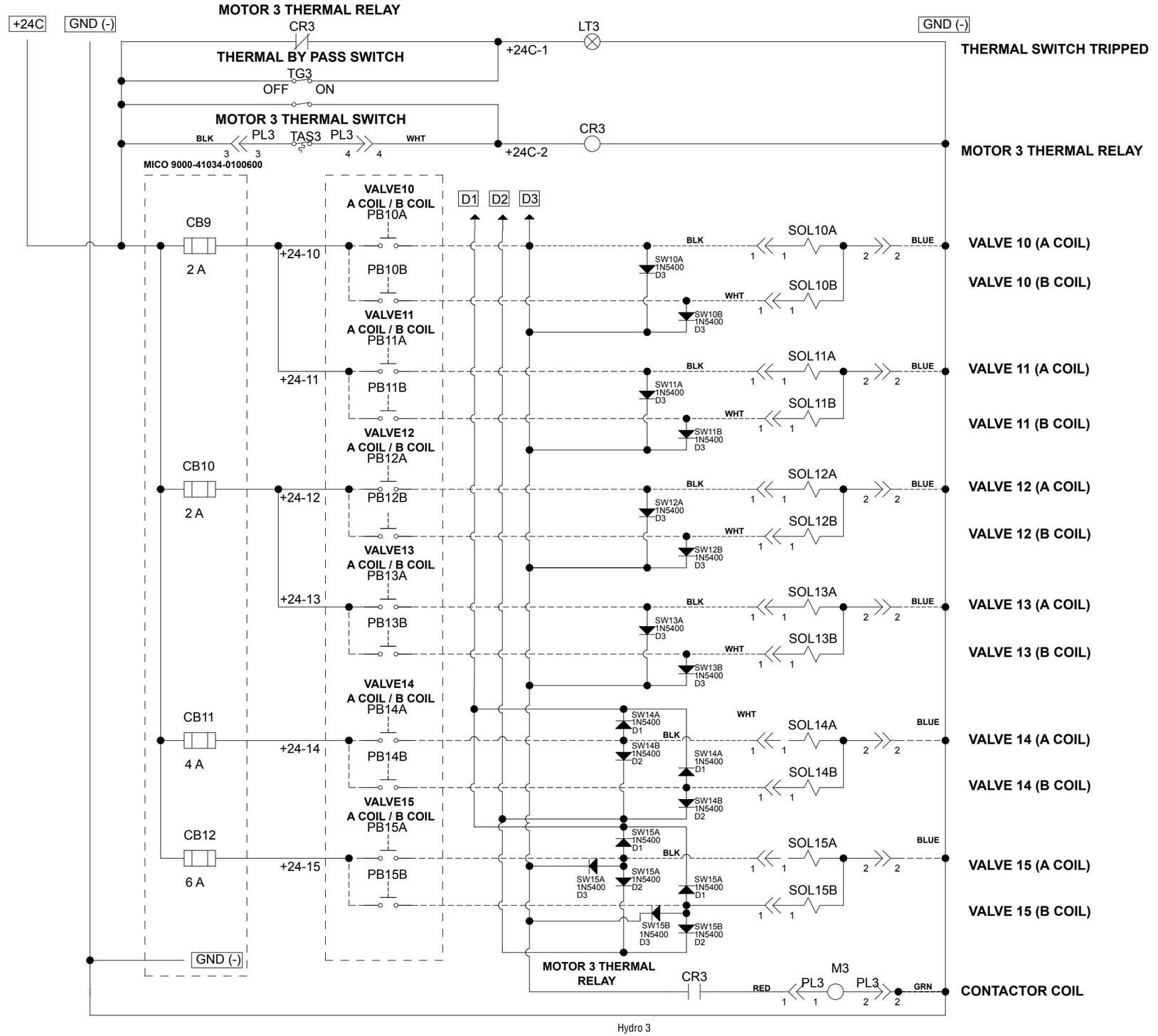



Customer Supplied Switches
24 VDC POWER
15 A
CB0
+24
MOTOR #1
CONTROL POWER
ON OFF
TG1
MOTOR #2
CONTROL POWER
ON OFF
TG2
+24B
MOTOR #3
CONTROL POWER
ON OFF
TG2
+24C
GND (-)
OFF ON
MOTOR 1 THERMAL SWITCH
BLK
PL1
TAS1
PL1
WHT
3
3
4
4
CR1
+24A-2
MOTOR 1 THERMAL RELAY
MICO 9000-41034-0100600
+24A
CB1
2 A
+24-1
VALVE1
A COIL / B COIL
PB1A
PB1B
BLK
SW1A
1N5400
D1
SOL1A
BLUE
VALVE 1 (A COIL)
WHT
SW1B
SOL1B
VALVE 1 (B COIL)
VALVE2
A COIL / B COIL
CB2
2 A
+24-4
PB2A
PB2B
SW2A
SOL2A
VALVE 2 (A COIL)
SW2B
SOL2B
VALVE 2 (B COIL)
VALVE3
A COIL / B COIL
CB3
2 A
+24-3
PB3A
PB3B
SW3A
SOL3A
VALVE 3 (A COIL)
SW3B
SOL3B
VALVE 3 (B COIL)
VALVE4
A COIL / B COIL
CB4
2 A
+24-4
PB4A
PB4B
SW4A
SOL4A
VALVE 4 (A COIL)
SW4B
SOL4B
VALVE 4 (B COIL)
GND (-)
MOTOR 1 THERMAL
RELAY
CR1
D1-1
M1
RED
GRN
CONTACTOR COIL
D1
+24C
+24B
GND

Customer Supplied Switches

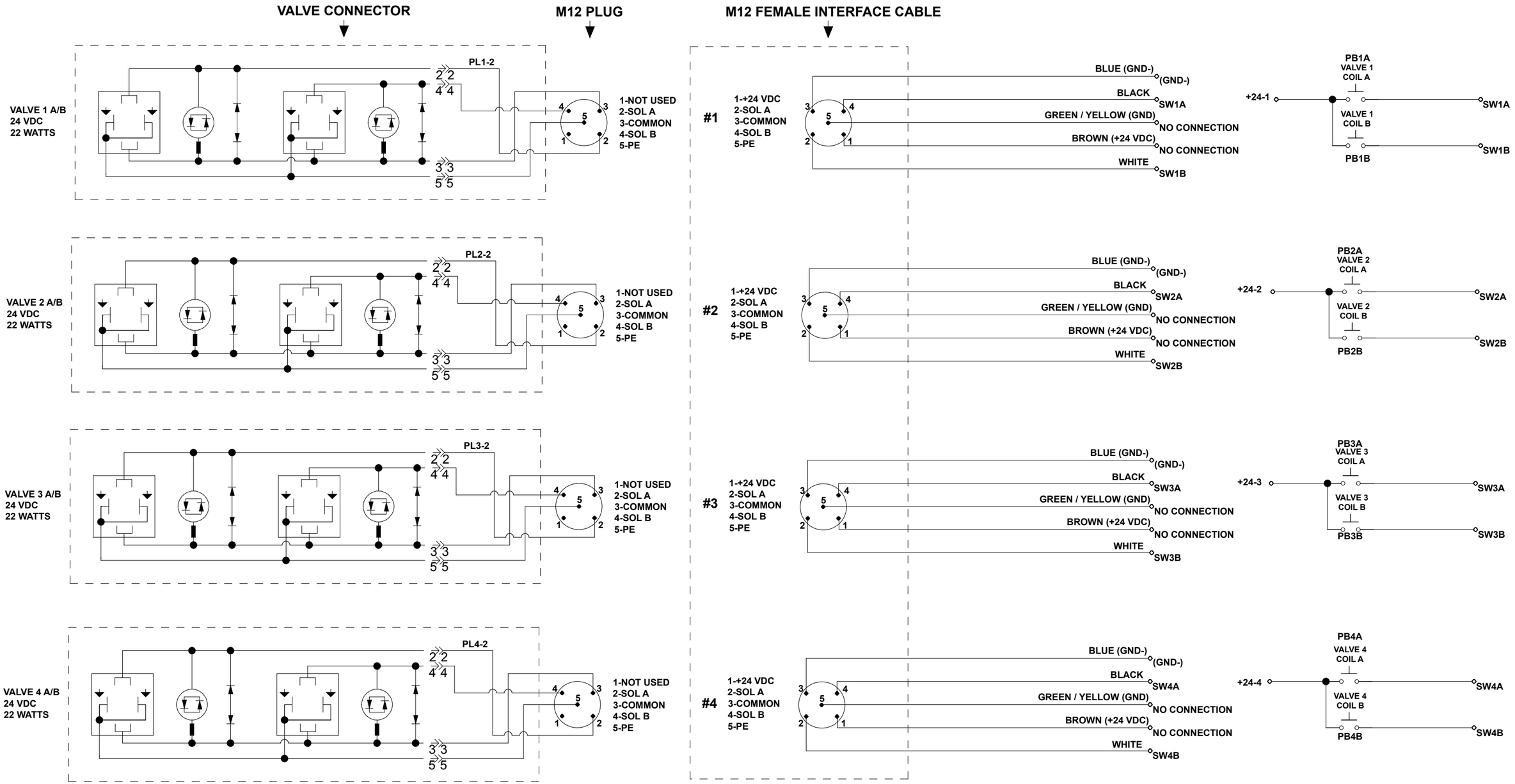


Customer Supplied Switches

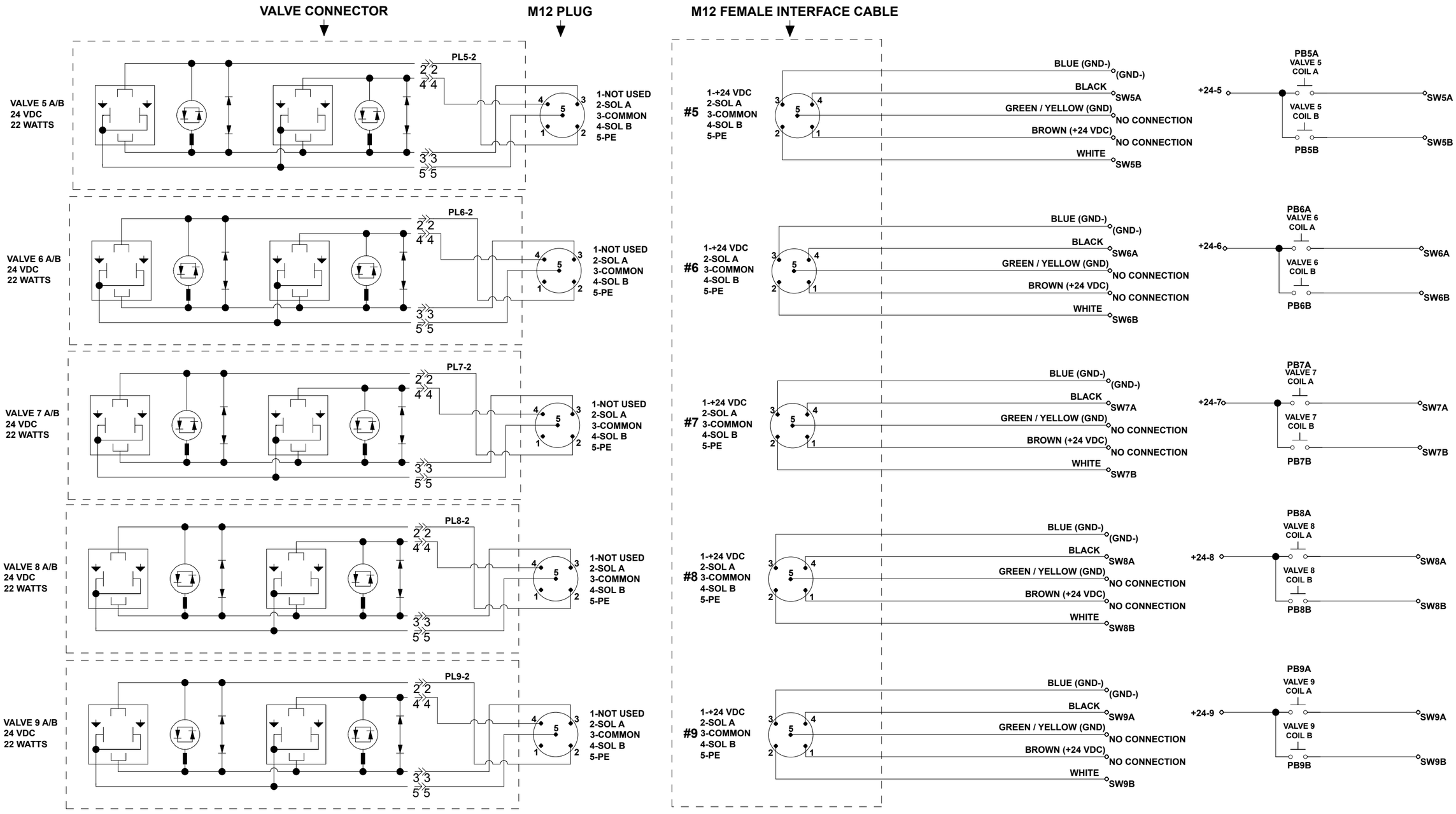


Valve and Switch Wiring Schematic (#1 – #4)

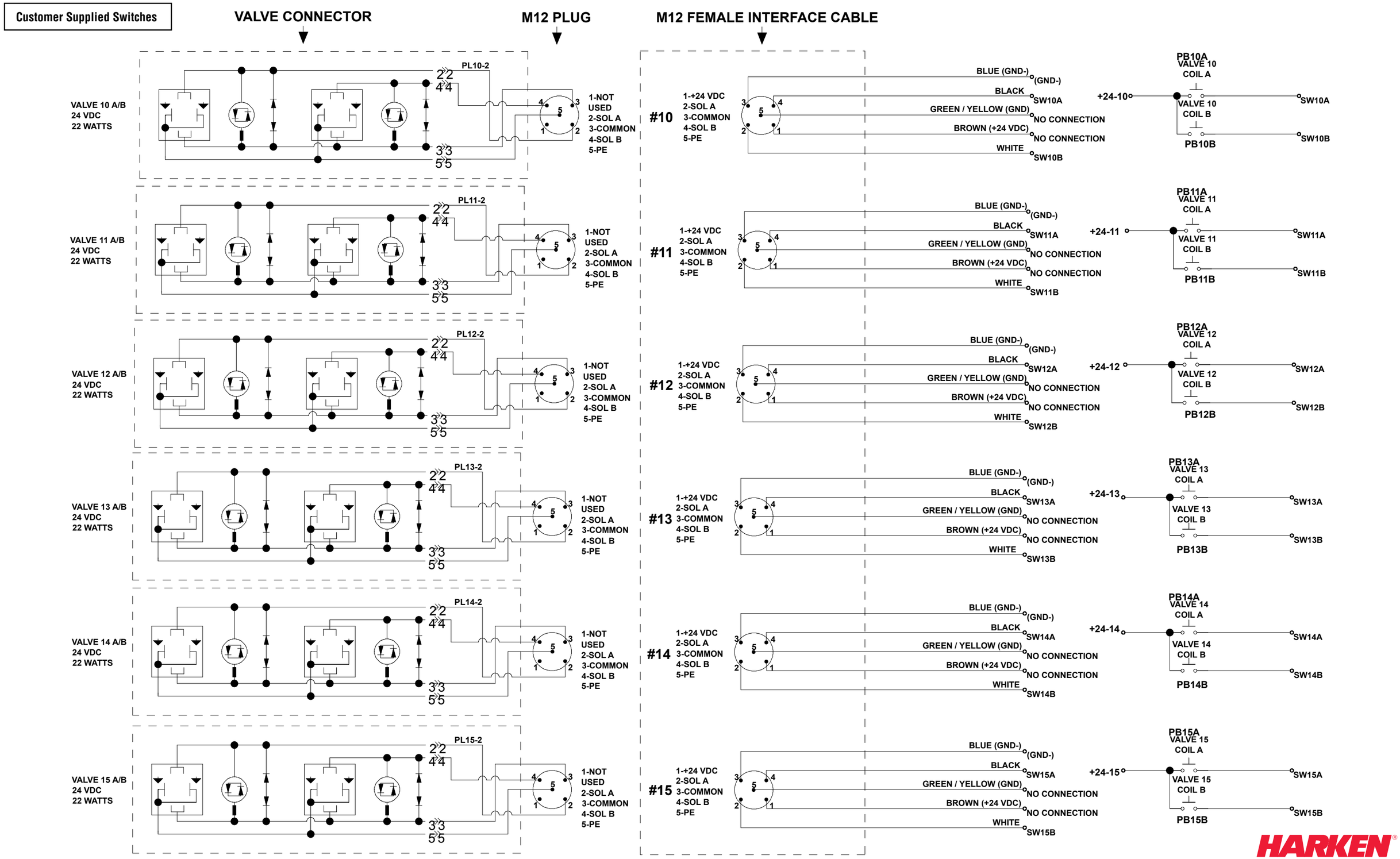
Customer Supplied Switches

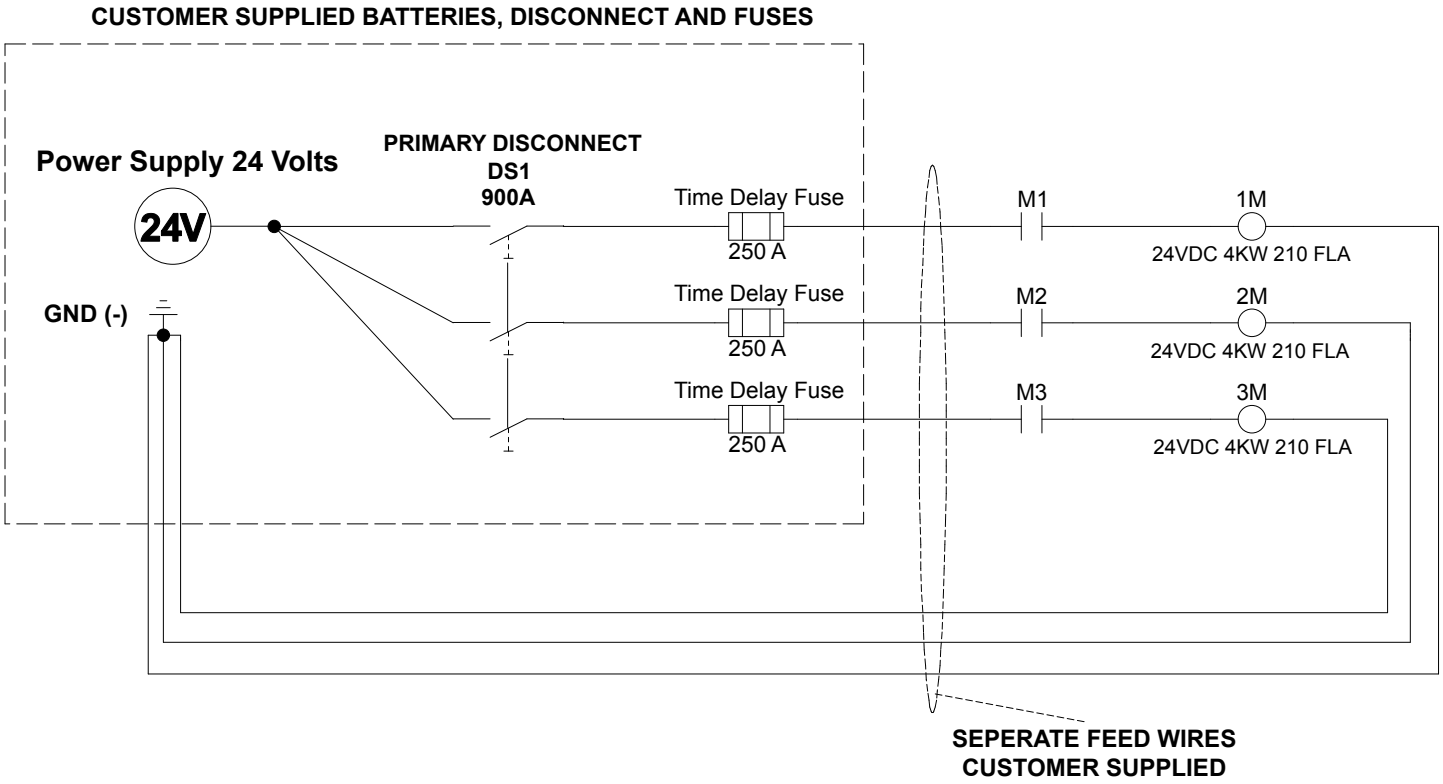


Customer Supplied Switches

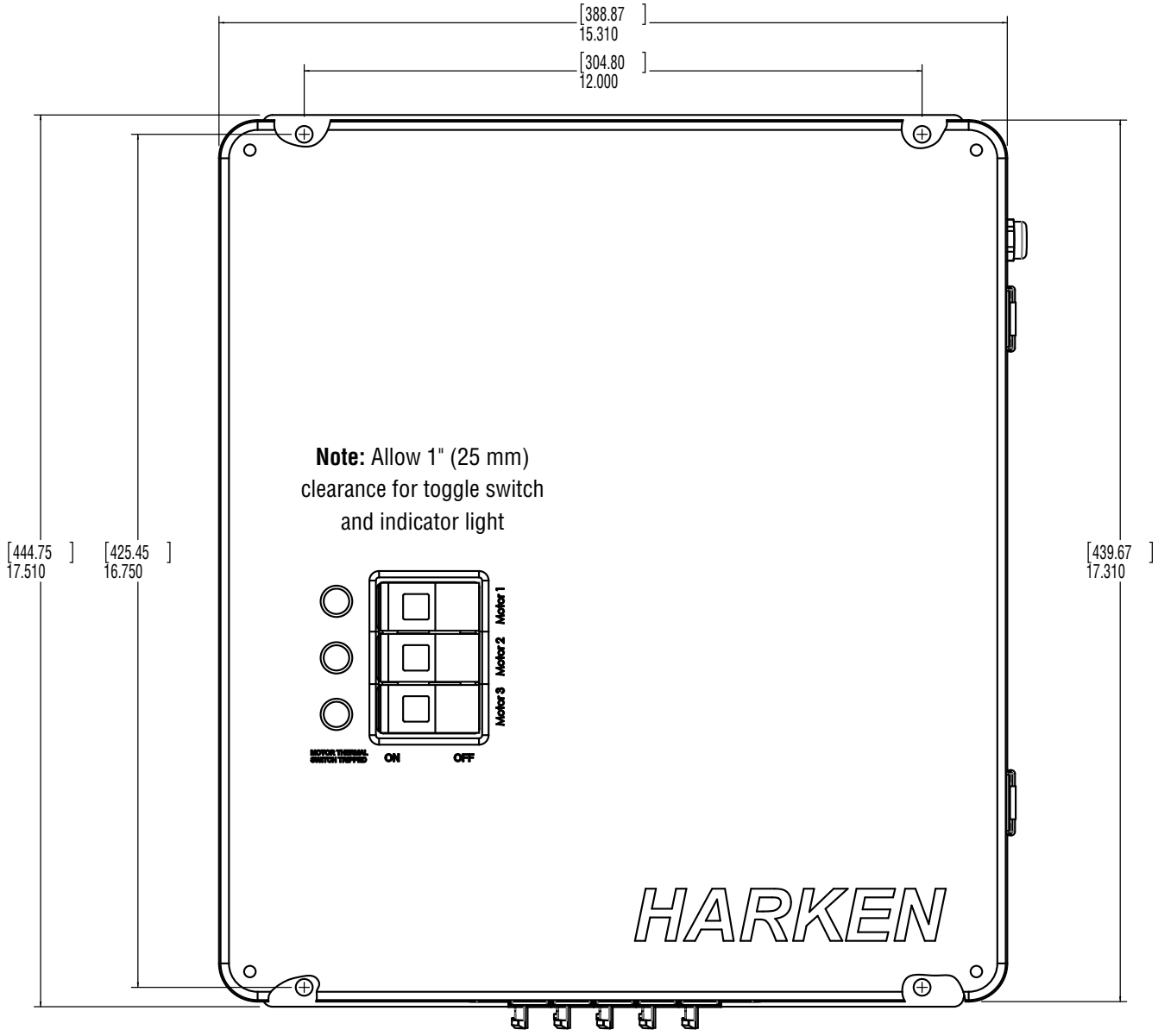


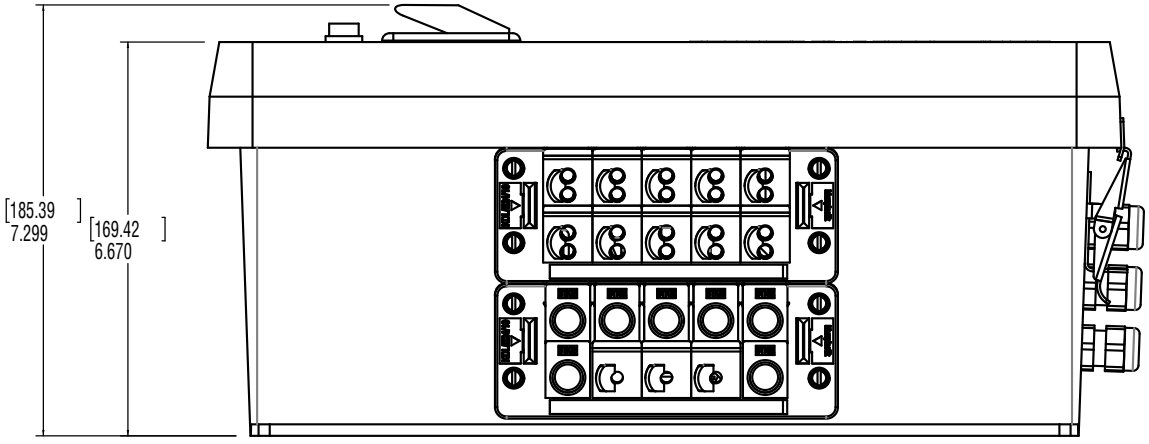
Valve and Switch Wiring Schematic (#10 – #15)



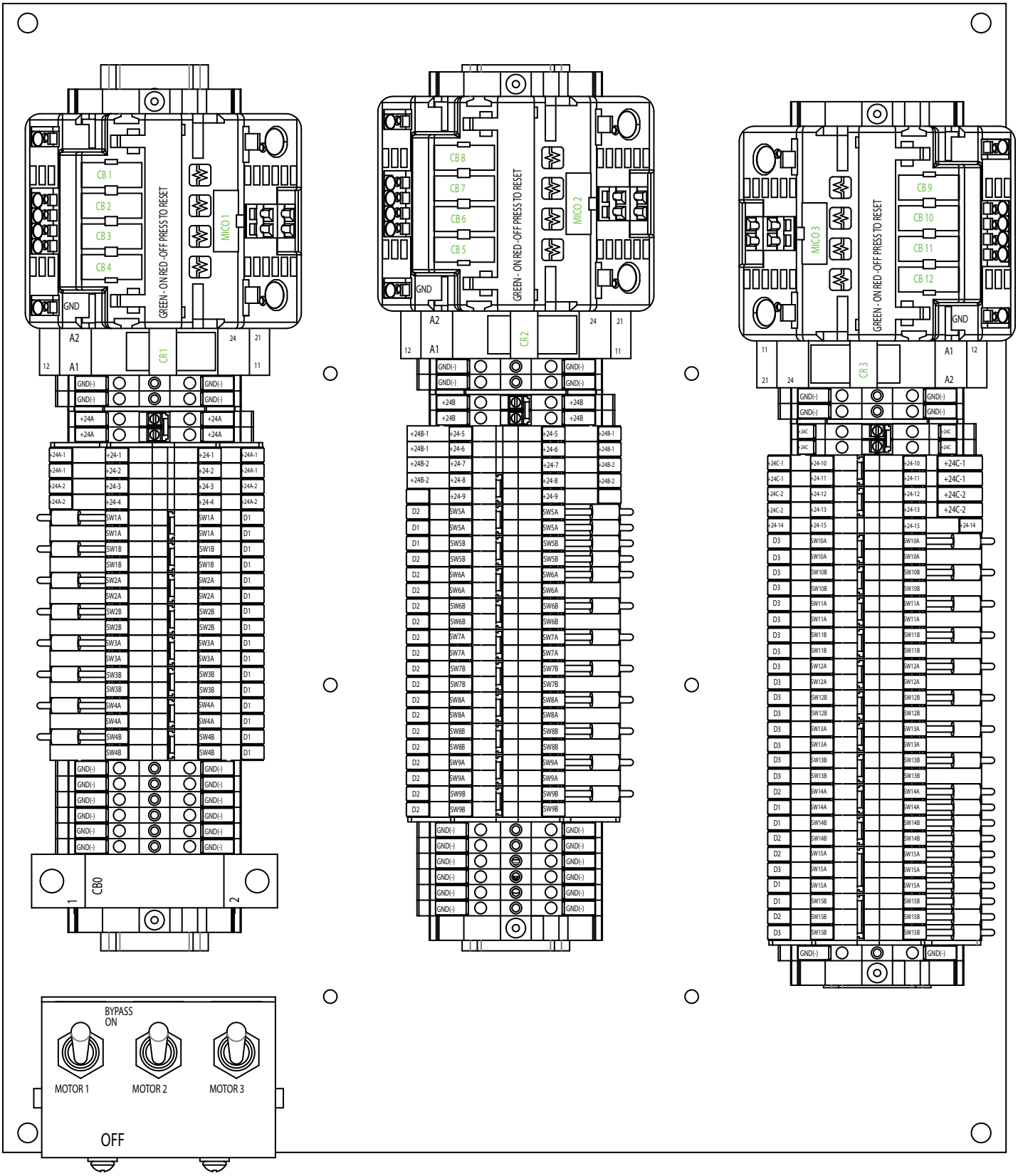

CUSTOMER SUPPLIED BATTERIES, DISCONNECT AND FUSES
Power Supply 24 Volts
24V
GND (-)
PRIMARY DISCONNECT
DS1
900A
Time Delay Fuse
250 A
Time Delay Fuse
250 A
Time Delay Fuse
250 A
M1
M2
M3
1M
24VDC 4KW 210 FLA
2M
24VDC 4KW 210 FLA
3M
24VDC 4KW 210 FLA
SEPERATE FEED WIRES
CUSTOMER SUPPLIED

Control Box Mounting Dimensions





Control Box Interior Layout



Warranty

Harken warrants that each Harken product, when properly used and maintained, will be free from defects in material and workmanship from the date of receipt of the product by the final customer. Harken products are covered by two different kinds of warranties, on the basis of the purchaser and use made of them. For complete warranty or for information relating to a specific warranty concern, please refer to the following:

Harken Catalog

Harken Website: www.Harken.com

Call or Email the nearest Harken Distributor

Harken Corporate Headquarters

HARKEN®

Corporate Headquarters
N15W24983 Bluemound Rd, Pewaukee, WI 53072 USA
Telephone: (262) 691-3320 • Fax: (262) 701-5780
Web: www.harken.com • Online Catalog: www.harkenstore.com
Email: harken@harken.com

Harken Australia Pty, Ltd.
1B Green Street, Brookvale, N.S.W. 2100, Australia
Telephone: (61) 2-8978-8666 • Fax: (61) 2-8978-8667
Web: harken.com.au • Email: info@harken.com.au

Harken France
ZA Port des Minimes, BP 3064, 17032 La Rochelle Cedex 1, France
Telephone: (33) 05.46.44.51.20 • Fax: (33) 05.46.44.25.70
Web: harken.fr • Email: info@harken.fr

Harken Italy S.p.A.
Via Marco Biagi, 14, 22070 Limido Comasco (CO) Italy
Telephone: (39) 031.3523511 • Fax: (39) 031.3520031
Web: harken.it • Email: info@harken.it

Harken New Zealand, Ltd.
30-36 Fanshawe Street, P.O. Box 1951, Auckland 1001, New Zealand
Telephone: (64) 9-303-3744 • Fax: (64) 9-307-7987
Web: harken.co.nz • Email: harken@harken.co.nz

Harken Polska SP ZOO
ul. Rydygiera 8, budynek 3A, lokal 101, I piętro, 01-793 Warszawa, Poland
Tel: +48 22 561 93 93 • Fax: +48 22 839 22 75
Web: harken.pl • Email: polska@harken.pl

Harken Sweden AB
Main Office and Harken Brandstore: Västmannagatan 81B
SE-113 26 Stockholm Sweden
Telephone: (46) 0303 61875 • Fax: (46) 0303 61876
Mailing address: Harken Sweden AB, Box 64, SE -440 30 Marstrand
Web: harken.se • Email: harken@harken.se

Harken UK, Ltd.
Bearing House, Ampress Lane, Lymington, Hampshire S041 8LW, England
Telephone: (44) 01590-689122 • Fax: (44) 01590-610274
Web: harken.co.uk • Email: enquiries@harken.co.uk

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